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ABSTRACT

Eight tech prep consortia located across the United States were studied to assess their tech prep implementation and outcomes. Special attention was paid to the consortia's use of and success with the following tech prep components: formal articulation agreements; core curriculum; rigorous instruction emphasizing integration of academic and vocational education; theory-practice linkages; efforts to increase access and opportunity; and transitions to college and work. The following were among the key findings: (1) tech prep has clearly broadened beyond the "neglected majority"; (2) in most consortia, tech prep and school-to-work initiatives were closely coordinated, especially when youth apprenticeships were involved; (3) consortia increasingly linked tech prep to efforts to meet state standards, which could displace its focus on work force preparation; (4) consortia increasingly sought to emphasize contextual teaching and learning, project-based instruction, and other applied teaching techniques; (5) schools involved in tech prep experienced increased collaboration among

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academic and technical instructors and among educators and business representatives; (6) a high percentage of tech prep participants continued to postsecondary education; and (7) although the consortia are successfully implementing individual components of tech prep, there remains a need to coalesce the individual tech prep components into comprehensive, career-focused structured programs of study. (MN)

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Promising Tech Prep Outcomes

by Bettina Lankard Brown

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Tech Prep was an idea conceived by Dale Parnell (1985) and described in his book ***The Neglected Majority***. Concerned about the large numbers of students who were being overlooked by typical reform agendas, Parnell foresaw a need for linking education to the workplace through applied learning programs. The Carl D. Perkins Vocational and Applied Technology Act of 1990 offered federal endorsement to this educational concept. The Tech Prep Education Act, which was part of this legislation, targeted funding to the implementation of 2+2 programs, which provided sequential study from the last 2 years of high school through the first 2 years of postsecondary education at a community/technical college.

Tech Prep was intended to ensure rigorous academic and career-technical programs of study that would allow for seamless transitions between secondary and postsecondary institutions. Tech Prep programs were directed to students who were not committed to attending college and who might not pursue the postsecondary-level math, science, and technology studies required for technical careers. The School-to-Work Opportunities Act (STWOA) of 1994 reinforced the Tech Prep model and expanded the notion of secondary-to-postsecondary articulation as part of a broader reform effort for all students (Bragg 2000). The Carl D. Perkins reauthorization legislation passed in 1998 supported articulating Tech Prep programs with baccalaureate degree curricula, offering another option for high school graduates completing 2-year college Tech Prep programs. It endorsed the proposition that all high school students should participate in higher-level math and science instruction (Bragg et al. 1999).

What do we know about the effects of Tech Prep on students' educational experiences and outcomes, especially the transition to college and work? In 1998, the National Center for Research in Vocational Education began a longitudinal study of Tech Prep experiences of students in urban, suburban, and rural sites in eight Tech Prep consortia across the country; the study is being continued by the National Research Center for Career and Technical Education. The purpose of the study was to explore the nature of student transitions from high school to college and work and to compare the education and economic outcomes of both Tech Prep and non-Tech Prep participants. The consortia selected for the study are as follows:

1. East Central Illinois Education-to-Careers Partnership, Danville, IL
2. Miami Valley Tech Prep Consortium, Dayton, OH
3. Golden Crescent School-to-Careers/Tech Prep Consortia, Victoria, TX
4. Hillsborough Tech Prep Consortium, Hillsborough County and Tampa, FL
5. Mt. Hood Educational Partnership, Mt. Hood, OR
6. Metropolitan Tech Prep Consortium (pseudonym) located in a large metropolitan area of the U.S.
7. Guilford Tech Prep Consortium, Guilford County and Greensboro, NC
8. San Mateo Tech Prep Consortium, San Mateo County, CA

Table 1 details the setting, partners, and types of programs in each consortium. This ***Highlight Zone*** distills the findings of the first 3 years of this ongoing study (Bragg et al. 1999; Bragg 2001).

Tech Prep Implementation and Outcomes

The Perkins legislation and subsequent research have identified several core components of Tech Prep programs (Bragg 2000; Hershey et al. 1998):

1. **Formal articulation agreements** that provide for a well-planned, sequential pathway from high school to postsecondary education
2. **Core curriculum**. The original Tech Prep design is described as the 2+2 approach, which includes a common core of math, science, communications, and technology courses beginning in the last 2 years of high school and extending through 2 years of more specialized courses at the postsecondary level. Later

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Table 1. The Eight Consortia

	East Central (IL)	Miami Valley (OH)	Golden Crescent (TX)	Hillsborough (FL)
Community	Rural, small town	Urban, suburban, rural	Rural, small town	Urban, suburban, rural
Partners	12 high schools, 1 area vocational center, 1 community college	64 comprehensive high schools feeding into 3 vocational high schools, 1 community college, 1 small business college, 1 four-year university	17 public school districts (18 high schools), 1 regional career center, 1 community college, 1 upper-division campus of a state university	19 high schools, 3 adult technical centers, 1 large community college with 4 campuses
Goal	To improve educational options for students in the neglected majority.	To provide a seamless education pathway from high school to postsecondary education for all students, but targeted to the middle majority.	To fully prepare all youth for rewarding careers in a high-quality work force.	To improve education and work opportunities beyond high school for all students, especially the neglected majority; increase relationships with business partners in the community.
Primary TP Model/ Articulation Agreement	Enhanced vocational TP, based on 4+2 agreements with some 4+2+2 arrangements. Youth apprenticeship program for selected students. Articulation agreements placed limited emphasis on course-to-course or program-level articulation.	Structured, comprehensive TP model implemented as 2+2 or 2+2+2 arrangements, supported by memoranda of understanding.	Enhanced vocational TP, 4+2 model, with some 4+2+2 programs. Most articulation agreements reflect course-to-course articulation of technical courses and provide dual credit, with enhanced or advanced skills curriculum.	Enhanced vocational TP, 4+2 articulated program with some 4+2+2 programs. Agreements include dual enrollment, time-shortened courses, and course-to-course articulation of technical courses.
Definition of TP Student	Has made a conscious decision to follow a clearly defined sequence of courses to prepare for employment in a Tech Prep occupation; offers opportunities for above-average entry wages and potential for growth; and requires advanced technical, problem-solving, and creative-thinking skills.	Enrolled in a state-sanctioned TP program that begins in Grade 11 and continues through the Associate degree in the career/technical education and employability competency delivery system.	One who is in grades 9-12 and who follows an approved TP sequence of courses leading to postsecondary education and training. A postsecondary TP student has an approved major leading to a state-approved Associate of Applied Science degree.	One who has completed at least one technical course in an articulated program by Grade 11 and two courses each of English, science, and mathematics and who takes an articulated sequence of technical courses the first 2 years of postsecondary education that lead to an AAS degree.
TP Courses	Integrated academic and technical content, workplace skill development, and work-based learning experiences.	Include those of an articulated vocational program and includes at least one applied academic course.	Core curriculum of academic courses and a sequence of career and technical courses of at least 3½ credit hours. Content is aligned with courses taught at the partner college and encourages post-high school options, including four-year college.	Articulated sequence of technical courses. In the College Tech Prep option, must satisfy a foreign language requirement and cannot include lower-level courses in the programs.
Highlights	Local businesses were vocal and active partners, encouraging work-based learning opportunities for students, supporting youth apprenticeship programs, and providing work-site learning opportunities to faculty. System focused on linking school-based learning and work-based learning.	Driving the TP curriculum are the skill competencies identified by local business and industry leaders as necessary for employment in particular jobs within an occupational cluster. Faculty work with these partners to develop curriculum based on the identified competencies.	Aspires to strengthen business/industry-postsecondary education relationships. Encourages the use of contextual teaching and learning and provides professional development workshops for faculty. Regional labor market information links education to the economic needs of the region.	While emphasizing applied academics, extended emphasis on standard academic courses with contextual learning strategies. Business and industry contribute to the training and development of faculty and counselors to promote awareness beginning in elementary school.

Source: Bragg (2001); Bragg et al. (1999)

	Mt. Hood (OR)	Metropolitan (pseudonym)	Guilford Tech (NC)	San Mateo (CA)
Community	Suburban	Urban, suburban, rural	Rural	Suburban, few urban
Partners	1 regional educational service district serving 7 high schools, 1 community college district, 1 postsecondary proprietary school	15 high schools, 1 technical college	1 school district that includes 14 high schools and 1 area vocational school, 1 community college	19 high schools, 1 community college district (3 community colleges)
Goal	To ensure that students acquire skills needed in a modern, technologically driven world.	To increase the comprehensiveness and coordination of high school students' technical education and their awareness of and access to technology careers.	To prepare students to live and work in a highly technological society.	To move students toward high skills and high-wage earnings.
TP Model/ Articulation Agreement	Enhanced vocational TP, 2+2 approach. The Tech Prep Associate Degree (TPAD) includes advanced or dual credits in either academic or professional-technical courses.	Integrated TP, interdisciplinary curriculum, articulated credits, and advanced placement; 2+2 approach, with some 2+2+2 programs.	Structured, comprehensive TP, 4+2 articulation; advanced standing credit and concurrent enrollment.	Enhanced vocational TP, 2+2 approach. Driving this model are the articulation agreements that provide for dual credit and advanced placement articulation options.
Definition of TP Student	One who elects to enroll in a major TP course of study in Grade 11 or 12 and follows an integrated program of academic and technical courses that is linked to 2-year AAS degree programs at the local community college.	Student in Grades 11 and/or 12 who is enrolled in TP math and English courses and who follows a technical career cluster of courses with the intent of entering the postsecondary TP curriculum.	One who elects to participate in a sequence of technical courses. College TP program has served to replace the general track. Youth Apprenticeship based on 2 years of technical courses in high school, followed by a 2-year AAS program.	One who has completed an articulated vocational course in high school that is part of a TP program of study.
TP Courses	Reflect an integrated program of academic and technical concepts and are designed to reduce the need for course repetitions in the first year of college. Provide more opportunities for acceleration and advanced studies in college programs.	Include a sequence of applied classes as well as courses that integrate vocational and academic content. Internships, paid work placements, and school-based enterprises reflected the various work-based learning opportunities offered to students.	College TP and vocational TP course requirements are similar; vocational TP requires four sequenced technical courses completed as electives, which can be substituted for the foreign language requirement.	Specifically sequenced within a specific technical area designated as TP by the Consortium.
Highlights	TP curriculum was influenced by the State Department of Education, state officials, and representatives from the school. Articulated academic courses, career pathways, and links to School-to-Work efforts guided reform. Community members and parents participated in the decision-making process regarding reform efforts.	Interdisciplinary approaches to academic and vocational integration, secondary to postsecondary transition, and professional development opportunities for high school teachers, college faculty, and local administrators guided consortium efforts.	Has built extensively on the state's early priority for a College TP course of study, supplemented with a solid commitment from local business and industry to the YA model. Business and industry partnerships have resulted in the establishment of shared goals of improving the skill level and quality of the county's entry-level work force and provide youth with multiple career and educational options.	There has been a deliberate attempt to align the goals and activities of TP with School-to-Work. Career pathways are used to support seamless high school transitions.

regulation extended course sequences to include the first 2 years of high school (Hershey et al. 1998).

3. **Rigorous instruction** as a means of providing all students with a sound educational foundation in high school that facilitates better high school transitions to further education or employment
4. Meaningful **linkages of theory and practice**
5. **Access and opportunity** for all students
6. **Transition to college and work**

The following discussion highlights ways in which the consortia implemented these components.

Articulation Arrangements

Formal articulation agreements were established to facilitate students' high school transitions to postsecondary programs. These agreements reflected one of the following options for sequential years of education:

2+2: grades 11-12 plus 2 years postsecondary
2+2+2: grades 11-12, plus 2 years at 2-year college and 2 years at 4-year college
4+2: grades 9-12, plus 2 years postsecondary
4+2+2: grades 9-12, plus 2 years at 2-year college and 2 years at 4-year college

In all approaches, students followed an established and logical sequence of courses that facilitated high school transitions by offering dual credit and course-to-course articulation in technical areas. Most postsecondary curricula led to an Associate Applied Science (AAS) degree. Although "many students failed to capitalize on the college credits they acquired in their secondary Tech Prep programs" (Bragg et al. 1999, p. 7), some consortia had more success with articulation. For example, in Golden Crescent, over one-quarter of all graduates of the 20 high schools have participated in articulated courses, many earning dual credits (Bragg 2000). Articulation did result in a number of benefits from improved communication between secondary and postsecondary institutions about content, standards, and continuous review and updating of courses.

Core Curriculum

Several models of Tech Prep programs that were identified by Hershey et al. (1998) and Bragg (1995) were used by the consortia:

- **Structured, Comprehensive Model.** Provides students with "a sequence of integrated career/technical and academic courses in high school that have a broad career focus but lead to a more specialized program or set of programs at the postsecondary level" (Bragg 2001, p. 23). Students in this model of Tech Prep program are selected, grouped together, and labeled, e.g., as in career academy programs. (East Central, Miami Valley, and Mount Hood consortia)
- **Enhanced Vocational Model.** In this model, "career/technical education programs provide the foundation for Tech Prep by targeting students who have traditionally participated in career-focused curriculum and encouraging them to take applied academics courses and/or other appropriate academic courses to complete a specified core curriculum" (ibid., p. 24). Students in these programs are not grouped into special classes, but they participate with other students in "courses that are open to all students who meet the high-school Tech Prep curriculum requirements as preparation for the postsecondary level" (ibid.). (East Central, Hillsborough, Golden Crescent, Mount Hood, San Mateo)
- **Work-based Model.** Deliberately organized to link learning in the workplace with school-based experiences, as in TP/youth apprenticeship. (East Central, Guilford)
- **Integrated Tech Prep Model.** Integrated academic and career-technical curriculum around career clusters or pathways from high school to the postsecondary level. (Metro)
- **College Tech Prep Model.** Links tech prep with academics that meet 4-year college requirements. (Guilford, Golden Crescent, Hillsborough).

Rigorous Instruction

From its inception, Tech Prep has emphasized the integration of academic and vocational curricula, and as it evolved it has been increasingly linked to enhanced academic coursetaking and higher standards. In half the consortia, more than half the TP participants started high school below Algebra I, but nearly all complete this level and some more advanced courses. In two consortia where the majority of TP participants started below Algebra I, most completed Algebra II or above by graduation. In four of the eight, more TP participants than nonparticipants completed Algebra II or above (see Table 2).

Theory-Practice Linkages

Work-based learning strategies were emphasized at all of the sites, but were varied depending on geographic location and local industries. The East Central and Guilford consortia, located in rural communities where manufacturing is the main industry, offered the most extensive work-based learning through their Tech Prep/youth apprenticeship approach. School-to-college matriculation rates in these programs are very high. In East Central, 95% of youth apprentices continued to community college, and many of them plan to continue to 4-year programs. Consortia also used job shadowing, cooperative learning, internships, manufacturing apprenticeships, and mentoring to link theory and practice.

Access and Opportunity

Tech Prep enrollments increased in all consortia from 60 percent to 250 percent, with about 15 percent of all high school students considered to be Tech Prep participants (Bragg et al. 1999). The majority of students enrolled in Tech Prep the last 2 years of high school–grades 11 and 12. At least 50% were the "neglected" or middle majority; however, the more rigorous the secondary curriculum, the more attractive it was to top-level students. Technology-based programs also attracted students.

The gender of Tech Prep and non-Tech Prep participants was fairly evenly split in five of the eight consortia. Those in which the proportion of males was higher than that of females emphasized youth apprenticeship and/or had specific admission requirements for Tech Prep. Minority enrollment in Tech Prep was reflective of the

Table 2. Math Starting Points and Completion Rates
(percentages rounded to nearest whole number)

	% Students Starting Below Algebra I			% Students Starting with Algebra I or Higher			% Completing Algebra I			% Completing Algebra II or Higher		
	TP	NTP	YA	TP	NTP	YA	TP	NTP	YA	TP	NTP	YA
East Central	66%	58%	66%	34%	42%	34%	80%	85%	89%	44%	53%	43%
Miami Valley	86%	36%	-	15%	64%	-	95%	97%	-	60%	65%	-
Golden Crescent	21%	25%	-	79%	75%	-	99%	97%	-	69%	65%	-
Hillsborough	70%	48%	-	30%	52%	-	94%	98%	-	54%	87%	-
Mt. Hood	68%	54%	-	32%	46%	-	87%	86%	-	23%	38%	-
Metro	48%	66%	-	52%	34%	-	100%	100%	-	57%	42%	-
Guilford	37%	41%	39%	63%	59%	62%	99%	92%	100%	90%	78%	87%
San Mateo	48%	53%	-	52%	47%	-	92%	74%	-	66%	65%	-

Source: Bragg (2001)

TP=Tech Prep
NTP=Non-Tech Prep
YA=Youth Apprenticeship

minority representation in the overall school population. Diversity among Tech Prep participants reflected the demographics of the local communities (Bragg 2001).

In three consortia (East Central, Guilford, and Hillsborough), Tech Prep participants were more likely to come from lower-income families in which the parents' education was less than college, suggesting that Tech Prep provided opportunities to lower socioeconomic status groups who were likely to be first-generation college students.

Table 3 depicts the demographic characteristics of students in the consortia.

Transitions to College and Work

Because the overarching goal of Tech Prep is preparing students for postsecondary education and the work force, outcomes in this area are particularly important. At least 65 percent of all consortia Tech Prep participants enrolled in some form of postsecondary education within 3 years of high school graduation. Most transitions were to community or 2-year colleges, but 4-year college enrollment was also substantial. In two consortia, around 50 percent went to 4-year colleges: Guilford, which emphasized the College Tech Prep model, and Metro, which focused on college readiness.

Tech Prep participants were more likely than nonparticipants to be working, especially full time. In three consortia, 30 percent went directly to work following high school graduation, but the majority across consortia worked while attending college (Bragg 2001).

Tables 4-5 depict the transition patterns to college and work of Tech Prep and non-Tech Prep students.

Table 3. Students' Demographic Characteristics by Consortium

	Female			Minority			Fathers with Less than College			Family Income under $30,000		
	TP	NTP	YA	TP	NTP	YA	TP	NTP	YA	TP	NTP	YA
East Central	43%	55%	22%	11%	8%	10%	49%	45%	55%	30%	19%	15%
Miami Valley	36%	50%	-	9%	13%	-	51%	37%	-	21%	16%	-
Golden Crescent	55%	49%	-	43%	39%	-	49%	47%	-	28%	34%	-
Hills-borough	54%	50%	-	36%	29%	-	53%	38%	-	35%	22%	-
Mt. Hood	42%	46%	-	15%	19%	-	40%	36%	-	26%	28%	-
Metro	56%	56%	-	84%	93%	-	59%	62%	-	59%	61%	-
Guilford	56%	53%	33%	47%	44%	43%	51%	41%	41%	31%	11%	20%
San Mateo	48%	51%	-	65%	63%	-	30%	21%	-	17%	11%	-

Source: Bragg et al. (1999)

Table 4. Postsecondary Transition Patterns of Tech Prep and Non-Tech Prep Students
(percentages rounded to nearest whole number)

	2-yr College			4-yr College			No Postsecondary		
	TP	NTP	YA	TP	NTP	YA	TP	NTP	YA
East Central	59%	57%	86%	5%	18%	4%	27%	20%	4%
Mizmi Valley	75%	36%	-	7%	42%	-	7%	10%	-
Golden Crescent	43%	37%	-	17%	17%	-	16%	19%	-
Hills-borough	36%	36%	-	18%	35%	-	30%	15%	-
Mt. Hood	42%	40%	-	16%	23%	-	33%	26%	-
Metro	26%	33%	-	53%	46%	-	6%	12%	-
Guilford	31%	17%	39%	48%	55%	44%	13%	17%	13%
San Mateo	50%	47%	-	33%	32%	-	6%	6%	-

Note: Percentages do not add up to 100% because Table 4 does not include other post-high school transition paths (mixed 2-year and 4-year college attendance, proprietary school attendance, military service, etc.)

Source: Bragg et al. (1999)

Table 5. Work Transition Patterns of Tech Prep and Non-Tech Prep Students
(percentages rounded to nearest whole number)

	Full-Time Employment			Part-Time Employment			Unemployed*			Military/Other		
	TP	NTP	YA	TP	NTP	YA	TP	NTP	YA	TP	NTP	YA
East Central	55%	48%	60%	28%	38%	33%	14%	13%	7%	3%	2%	0
Miami Valley	46%	41%	-	44%	37%	-	7%	21%	-	3%	1%	-
Golden Crescent	40%	36%	-	40%	41%	-	16%	15%	-	5%	8%	-
Hillsborough	56%	46%	-	34%	42%	-	9%	11%	-	1%	1%	-
Mt. Hood	50%	42%	-	27%	39%	-	21%	17%	-	3%	2%	-
Metro	30%	34%	-	38%	39%	-	32%	25%	-	1%	2%	-
Guilford	46%	33%	43%	47%	11%	48%	11%	16%	8%	0	4%	0
San Mateo	32%	30%	-	47%	48%	-	17%	21%	-	5%	2%	-

Source: Bragg et al. (1999)

*Unemployed persons may be enrolled in college, seeking employment, or not seeking employment.

TP = Tech Prep
NTP = Non-Tech Prep
YA = Youth Apprenticeship

Summary of Outcomes

Tech Prep has clearly broadened beyond the "neglected majority," especially as STWOA came into play (Bragg 2001). In most consortia, the Tech Prep and STW initiatives were closely coordinated, especially in those with youth apprenticeship, perhaps demonstrating that "the limited resources associated with both reforms could be coordinated to create a more systematic approach" (Bragg et al. 1999, Concluding Observations-1). The sunset of STWOA, however, raises questions about the impact on Tech Prep.

Consortia increasingly linked Tech Prep to efforts to meet state standards, which could displace its focus on work force preparation. Consortia leaders "sometimes lacked the authority to bring about changes in the comprehensive high school needed for full implementation of Tech Prep" (Bragg 2001, p. v). In several consortia, close involvement of business and industry kept the focus on Tech Prep. The governance and administrative structures evolving from business-education partnerships influenced successful implementation and student outcomes (Bragg et al. 1999).

The raising of academic standards amplified the challenges involved in academic and vocational integration. To address this issue, the consortia increasingly sought to emphasize contextual teaching and learning, project-based instruction, and other applied teaching techniques. East Central, particularly, was faced with the task of attempting to change community perception of vocational education as predominantly focused on low-wage jobs. This may explain why the youth apprenticeship program at this site was exceptionally strong (ibid.).

One of the anticipated benefits of Tech Prep is the establishment and/or strengthening of linkages between high schools and colleges and employers. As a result of their participation in Tech Prep, schools in the study experienced increased collaboration among academic and technical instructors and among educators and business representatives. Local businesses were most effective as partners when their involvement was both active and vocal.

Among the most positive outcomes at all of the sites was the high percentage of Tech Prep participants continuing to postsecondary education. Future research will extend this finding by tracking the college readiness, persistence, completion, credentialing, and subsequent employment outcomes of Tech Prep participants.

The results of this study expand what is known about Tech Prep. Although consortia were successful at implementing individual components of Tech Prep, there remains a need to coalesce these elements into comprehensive, career-focused structured programs of study. In addition, the success of the career pathways and other models used by the consortia demonstrate how Tech Prep can play an important role in whole-school change. However, this should be accomplished without diluting Tech Prep's purpose as a comprehensive career-focused program of study.

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